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A REPORT ON THE REMEASUREMENT

OF THE PINE CREEK METHODS-OF-CUTTING PLOTS

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A REPORT ON THE REMEASUREMENT OF THE PINE CREEK METHODS-OF-CUTTING PLOTS, 1948

Introduction

In order to determine the most suitable method-of-cutting old growth ponderosa pine, seven permanent methods-of-cutting plots, located in the Pine Creek drainage of the Boise Basin Branch Experimental Forest, were established in the fall of 1933. The area had been logged in the spring and summer of this year. All trees in the 4-inch class or larger were tagged, measured, and tallied on special form 114, as detailed below. The intention was to remeasure the plots every 5 years, and at the same time to tag all trees which had grown into the 4-inch class, and to include the measurements for this ingrowth on a separate tally. Measurements of all plots were made in 1933 and 1938; plots 1-5 were remeasured in 1948.

Personnel

Personnel included James D. Curtis, Center Leader, who organized the work and was in the field on occasion. The field crew consisted of Robert W. Richman, and summer assistants R. O. Curtis who worked from July 22 through September 10, and Earl Marks from August 2 through September 15. Marks did not work on tally of plot 1, but remained to work on all the plot reproduction transects, after methods-of-cutting tallies were completed.

Over-all Procedure

General

General procedures followed the appended field work plan outlined by J. D. Curtis. (Appendix A) As work progressed, some deviations from

this plan were found more effective in the field; access to plots was revised; marking the trees on the subplot boundaries with a barkslapper was found better than laying string. The field crew consisted of 2 men, one tallying and measuring height; the other taking measurements at the tree. A 3-man crew was found to be less effective in this year's field work. Plots were not measured in consecutive order, but the ones suggesting most informative data were measured first.

As was anticipated, shortage of field personnel, and other work, made it impossible to finish all plots; plots 6 and 7 will be measured before growth begins in the spring of 1949.

Identification

Measurement of each plot was preceded by identification of cutting method. Next, the plots were marked with "traffic" yellow paint. This paint is very effective, although it needs to be thinned occasionally. Gasoline was used for the purpose. One gallon of paint, if properly thinned, will serve for about three plots. Angle-iron stakes designating subplot boundaries were completely painted. Trees facing the boundaries of plots were painted at diameter breast high, so that the boundaries could be recognized regardless of direction of approach to the plots. In a similar manner, subplot boundaries were marked with a barkslapper containing a yellow oxide powder which left a semipermanent mark on the trees.

A line of iron Reproduction Transect stakes crosses the middle of each plot. These were also painted, but on the top and outer side of the angle-iron only, to distinguish them from subplot corners which were

completely painted. In a few cases, however, the "concave" faces of a transect angle-iron were completely painted also.

Tagging

Within a given plot, trees were originally (1933) tagged consecutively, using 4-figure numbers always above 2,500, and beginning on subplot number A-1, progressing to A-2, and so on through A-5, then returning on the "B" row, first on B-5, B-4, etc. This continued, B-5 through B-1, C-1 through C-5, D-5 through D-1, E-1 through E-5. (For subplot layout see map in the file for each plot.) All tagging was completed on a given subplot before progressing to the next subplot. When ingrowth trees were tagged in 1938, the same order of tagging was followed, but numbers began with 1 and continued consecutively through the number of ingrowth trees on the plot. Furthermore, the 1948 ingrowth tagging again began on A-1, continuing with the next consecutive number after the last 1938 ingrowth number on E-5.

It will be clear that each plot is treated as a separate unit within the methods-of-cutting study. That is, the system and order of tagging and tallying was not continued from one full plot to the next, but rather, the system was repeated on the next plot.

In a few cases, tags were missing or buried. When such trees were discovered during tallying, the tag number was exposed with a knife or hatchet, if it was found to be buried; or otherwise a note was made of the missing number, and a tag made up that evening to replace the missing tag. When there was any doubt as to the number of a tree whose tag was missing, it was given a 1948 "ingrowth" tag until its true identity was

certain. When a number was not found, nor the tree located, a note of "missing" was made on the tally sheet opposite the number of the lost tree. It was sometimes possible to identify a fallen dead tree as the lost tree.

Tallying

The 1933 record sheets were recopied and the 1948 tally was continued thereon. (See form used, Appendix D). The copy also included the most pertinent previous tree data. (See Work Plan under Section 5, "Note taking.") A separate group of tally sheets was kept for the 1938 ingrowth trees, and still another set of sheets for 1948. On each plot and for each tree, record was made of tree number, species, diameter breast high (outside bark), total height, crown class, Keen tree class; and kind, cause, and extent of damage. On all successive plots only one out of five Keen class 1 trees was so measured; for the remaining 80 percent only number, species, diameter, and damage were taken in the field.

Diameter was measured by diameter tape, the usual precaution being taken to hold the tape at right angles to the axis of the tree. Since the tags were presumably placed at $4\frac{1}{2}$ feet from the ground, diameter measurements were always taken at the level of the tag when practicable. If the tag was at the level of a whorl of branches, the measurement was taken at an internode, preferably above the tag.

Height was measured with a percent abney and 100-foot chain tape for trees over 50 feet high, and with a folding type Christen hypsometer and 10-foot pole for smaller trees. When possible, measurement on leaning trees or those with sweep was made at right angles to the lean.

For the pole required with the hypsometer, a 10-foot section of Douglas-fir flooring was planed to 3-inch width and painted with yellow stripes at each foot of length; this was very effective in the field.

When using abney and chain, slope correction was applied when necessary. This correction was computed from the simple geometric relation for a right triangle that the square of the hypotenuse is equal to the sum of the squares of the other two sides. Or, when reduced to formula: $C = (\sqrt{100^2 + r^2}) - 100^2$

Where: C = Correction in feet, to be added to the 100-foot measurement made on the slope.

r = Rise, in feet, of the slope under consideration (rise in feet per 100 feet).

This value is the reading obtained on the percent abney when sighted to obtain percent of slope.

The values used in the field are as follows:

% slope	Exact correction, in feet	Correction used, in feet
10	0.5	1/2
15	1.1	1
20	2.0	2
25	3.1	3
30	4.4	4 1/2
35	5.9	6
40	7.7	8
45	9.7	10
50	11.8	12
55	14.1	14
60	16.6	17

The abney was checked at intervals for accuracy of adjustment.

It was frequently found on the taller trees that the 1948 height was shorter than the previous height measurements, although the leader had no appearance of damage, and had grown since last measured. Since measurements were rechecked and care was taken in the 1948 measurement it is assumed that these 1948 measurements are valid. Previous measurements were generally taken from the uphill side of each tree, regardless of the direction of lean. This could account for the discrepancy, as could an abney out of adjustment, or failure to allow a proper slope correction in the horizontal distance measurement.

As far as crown classes were concerned, in the unevenaged stand the degree of dominance was judged by the presence or absence of older trees. Thus while the crown class tally is somewhat arbitrary, it indicates as far as possible the dominance of a tree under present conditions. For instance, a tree 50 feet high might readily be in one location, a dominant; in another nearby location, an intermediate.

The tree classification system used for pine in 1948 was the Keen system, while the Dunning classification was used in 1933 and 1938. As these classifications are not believed suitable for Douglasfir, a separate Douglasfir classification system was started. (See below)

Since analysis of the data for some purposes will be grouped by Keen classes, it was necessary that all trees be reclassified according to the Keen classification. Therefore, the 80 percent of the second-growth trees which had not been given Keen class ratings in the field were reclassified using the conversion relations indicated by Briegleb. 1/

1/ Philip A. Briegleb, 1945, "Calculating the Growth of Ponderosa Pine Forests," p.56.

Consideration was given to both the past and present damage and other characteristics of each tree reclassified.

Damage had previously been tallied according to a "Code for individual tree records." (See Appendix B). This code of 1933 showed inconsistency in that it intermixed classes, kinds, and degrees of defect within the same code series. Therefore, for the 1948 tally, a new damage code was devised, giving a 3-series code which indicated separately, the class, the cause, and the extent of defect. (See Appendix C) For example, a catface of moderate severity due to fire, would be coded as: 1-7b. It would be underlined to show that it affected the first log (i.e., the first 16 feet above the stump height of 1 foot). In cases where the cause of the defect was not apparent, the middle series was omitted. For example, 5-c would indicate a fork whose cause had either been obscured by later growth of the tree, or which was due to the natural tendency of some individuals to fork.

In the use of the code the damage to market value of the tree, and to health and vigor, were considered. The extent of damage was generally coded as described on the code sheet, under "General use of severity rating." There were, however, exceptions in the case of catfaces, insect attack, and mistletoe. In cases where such use would obscure the extent of damage, the effect on market or lumber value was not considered, and the actual area of the defect and effect on the health and vigor of the tree were the only criterions. For instance, a catface in the butt log would almost always be rated as "c" in severity if market value were considered; for such a catface would much reduce the value of the butt

log. Since under these circumstances the relative size of the catface would not be indicated by the code, the market value must not be considered. To consider it would defeat the purpose of the code. The severity of a catface is judged, therefore, by considering only health and vigor of the tree and size of the catface.

Similarly, mistletoe damage was recorded irrespective of the market value, in order that the code would be an accurate indication of the extent of damage. Mistletoe was rated according to the degree of incidence, as indicated by number of brooms or swelled stems. Thus, one broom or localized attack affecting less than 2 feet of a main branch or stem, would be "a" severity. Two locations on a tree would give an extent rating of "b"; three or more brooms or separate locations of attack on a tree would be "c" severity; and more than half the live-crown height or area in mistletoe constitutes "d" severity.

On the other hand, it is obvious that defects such as sweep or lean which do not in themselves affect the health of the tree, but rather the market value, will be coded as advised under "General use of severity code." In no case does the coding consider the amount of future reduction of market value. Thus a girdled tip is rated "b", notwithstanding that it may in the future seriously impair the market value by forming a crook.

The earlier defects indicated on the 1933 and 1938 tallies were, on the newly copied forms, converted to the new code system. In some cases the structure of the old code made it difficult to appraise the

severity of the damage with preciseness. The only recourse was best judgment; all evidence deducible from the amount of recovery indicated in later records of damage, growth rate, etc., being utilized to aid in the conversion. Some factors were standardized within limits: Fire damage, 1 through 7, on the old code, was converted as follows: 1 is "a", 2 is "c", 3 is "b", 4 is "d", 6 is "b", and 7 is "c". Form was converted thus: 1, 2, and 3 become "b", 5 became "a". Rot became: 1 is "a", 2 is "b", or "c", 3 is "d". Porcupine damage changed as follows: 1 and 2 are "a", 3 is "b", or "c", 4 is "d". Logging damage: 1 is "a" to "c"; 2 is "b"; 3 is "c"; 4 is "b" or "c". In these cases, when a related damage was also indicated, the above severity was increased accordingly. Thus, when porcupine damage (e.g., 6-3) was accompanied by form damage such as spiketop (e.g., 3-3) the porcupine damage would be rated as somewhat more severe than otherwise.

Douglasfir Tree Classification Tally

A subsidiary tally of further characteristics of Douglasfir was made on plots 2 and 3 to aid in developing a tree classification for this species. While this study is rather indirectly related to the methods-of-cutting study for which the field work was primarily done, nevertheless the taking of Douglasfir data was done in conjunction with the other field work, and bears mention here. This tally required the recording of certain data as explained elsewhere in a separate report.

Reproduction Transects

Reproduction transects run across the plots from the middle of each side. These are marked by angle-iron stakes at every chain length.

These stakes were painted yellow in 1948 on their outer faces as explained above.

Reproduction counts were made on quadrats which flanked these transects, Each quadrat is 20 links (13.2 feet) long and 10 links (6.6 feet) wide. Thus the area of each quadrat is 0.2 chain by 0.1 chain, or 2 milacres, (.002 acre). The two transects on each 10-acre plot total 100 quadrats or 0.2 acre, or a 2 percent sample. In the case of plot 4, which contains an additional 2 acres across the north end, the transect does not continue into this supplementary area. The length of each quadrat had been marked by stakes along the transect line. These quadrat stakes were wooden markers, except on plot 2, where they are iron like the transect stakes, but were painted on the top only, to distinguish them from the transect stakes.

The quadrats lie on the left side of the transect line, as one progresses from quadrat number 1 through quadrat number 50. (Refer to map of the plot in question in order to find the location and beginning point of each transect.)

While previous counts made on the reproduction transects had included all vegetative cover, the 1948 count was made only for tree species. A sample of the tally form used is appended. (Appendix E)

Tallying Reproduction

A 6.6-foot pole was used for measuring the width of the quadrats. The most effective procedure found was to secure a chain-tape from one iron transect stake to the next, one chain distant. The tape was pulled tight and checked to see that it was aligned. Temporary stakes were

then set at the 13.2-foot points. From each set stake a measurement at the right angles to the tape could then be made with the 6.6-foot pole and a stake set at that point to mark the outer boundary of each quadrat. Additional check measurements by the tally man, with a 6.6-foot pole were sometimes necessary.

It is important that the tally man be able to identify and differentiate 1-year-old seedlings and 2-year seedlings. In some cases it is difficult to tell whether a given tree is inside or outside a quadrat. In such cases the location of the tree is judged from the position of the middle of the bole, at the ground level.

Time required

Total man-days required were 7-3/4 for the five Pine Creek plots together. A 2-man crew was used. It is probable that a 3-man crew could work much faster, with the procedures followed above.

Specific Field Procedures

The specific procedures followed in each plot are as follows:

Plot 1. Clear Cut to 15-inch Diameter Limit.

This plot was tallied during the period July 6-26 with some slight interruption in the form of Friday afternoon work at headquarters.

In all, 23 man-days were required to complete the intensive tally, of which 2 man-days were spent painting borders. A few hours might have been saved by avoiding half-days in the field, since about 1 hour was required in travel time to plot 1. Also, the practice of marking subplots by pulling a cord around the plot was time-consuming and was replaced on plot 2 by marking subplots with a barkslapper.

On plot 1, the subplot stake between A-4 and B-5 was not found. Boundaries for these subplots were approximated, with the help of numbers on tagged trees near the border, and after pacing and "sighting in" the corner from four directions.

The transect stake between C-3 and D-3 was found lying on the surface, and was reset at approximate position found by measurement with a 100-foot tape.

The plot was reached from the Pine Creek road by walking up the drainage in which plot 1 lies. This approach is a good half-mile walk on an easy trail. When the Pine Creek road is wet and slick, the plot is reached from the second switchback on the west Bannock road, by driving or walking north from that switchback, along the ridge; then walking down the west slope to plot 1. This approach is much shorter but much steeper than the approach from Pine Creek.

Every tagged tree on plot 1 was measured for all characteristics provided on Form 114. When the tally had been completed the 2-man crew returned to subplot A-1, and while one man tagged new "ingrowth" and measured diameters, the second man measured heights, and kept the tally of all characters. The plot was thus covered twice.

Plot 2. "High-grade" Economic Selection Cut, as practiced by Boise Payette Lbr. Co.

Plot 2 was tallied from July 26 - August 13; the time and efficiency being somewhat broken by interruption of the schedule to find more effective procedures; by time spent developing and using the Douglasfir crown tally; and by interruption for inspection and other duties in office.

Plot 2 was reached by the route which leads from Pine Creek to plot 1; plot 2 is on the right-hand or west of the drainage while plot 1 is on the east.

On plot 2 the plot boundary stake between E-2 and E-1 was not painted (since it could not be found at the time). It is located some 30 or 40 feet south by west of tree No. 7601, and perhaps 6 feet south of the large fallen tree nearby.

Total man-days spent on the plot were 31. This included $2\frac{1}{2}$ man-days marking the plot boundaries with a 2-man crew; 26 man-days tallying and tagging with a split 3-man crew; and $2\frac{1}{2}$ man-days spent on development of Douglasfir classification.

Due to the manner of tallying it is considered that at least a quarter of the time of the tally crew was concerned with the Douglasfir classification. On this basis, and considering that the crew consisted of 2 men at times and 3 at others, the number of man-days required for the different studies was approximately as follows:

Methods of cutting study:

Marking plot	$2\frac{1}{2}$ man-days
Tallying	$21\frac{1}{2}$
Total	24 man-days

Douglasfir classification:

Tallying	$4\frac{1}{2}$
Developing a classification	$2\frac{1}{2}$
Added time spent off plot	$2\frac{1}{2}$
Total	$9\frac{1}{2}$ man-days

In tallying plot 2, all trees on the A-row subplots were tallied. At this point a third man was added to the crew and it was decided to reduce the intensity of the second-growth height measurements to measurement of one tree in every five, starting with subplot B-5. This 20 percent sampling was controlled by taking height measurements on one-fifth of the immature trees on every tally sheet. Thus, since each sheet contains 40 trees, no less than 8 trees on each sheet of the 1933 tally, were measured for height. This was done when tally on each sheet was about half complete, as this made identification of trees quicker and easier. As these heights were being taken, a sufficient number of trees with ingrowth tags were measured to make up a 20 percent tally of height for ingrowth also.

Various combinations of crew work were tried during August 2, 4, and 5, to determine the most efficient use of time and crew. It was decided that although a 3-man crew could tally somewhat faster than a 2-man crew, yet a greater saving of time would be made if the third man tagged ingrowth, than if he worked with the tally crew. The third man tagged new ingrowth ahead of the tally crew and recorded diameters as he tagged.

Plot 3. Cut to a 25-inch Diameter Limit.

The plot was completed during the period August 16-27 requiring 22½ man-days, of which 4 were for marking the plot, 5 were for one man tagging, and the remaining 13½ were for tallying with a 2-man crew. A very small portion of this time was used for the Douglasfir classification tally which was terminated on this plot.

On plot 3 the subplot stake between D-2 and E-3 was not found in time to be painted. It lies about 1 foot north of the path or trail which runs between D-3 and E-3. The transect stake in the center of D-3 is not painted. It is some 6 feet south of the down logs nearby.

Plot 3 was reached by leaving the Pine Creek road at a point just east of plots 6 and 7, walking up the drainage and across the saddle just east of plot 7, then down the trail to the spring which is just west of plot 3 at subplot B-1. This route is shorter and steeper than the more frequently used route which leads from a point on the west Bannock Road, halfway between plots 4 and 5 at the low saddle on the ridge. This trail follows down the drainage to the spring which is just south of plot 5 at subplot A-1. From this point a path leads southeast up the spur drainage for several hundred feet, then westward over the first low ridge to the right, across the next small drainage and along the second small ridge to strike plot 3 about at A-3. When this last trail had been marked the crew found it preferable to the Pine Creek approach, especially as plots 4 and 5 were accessible at the same time, an advantage when two crews were working.

In tallying, the procedure was maintained of having one man tag ahead of the 2-man tally crew. However, the 1948 tagging, by error, did not follow the prescribed order on the B-row. Instead of moving in succession from B-5 through B-1, as on other tallies, the tag-man reversed the order, moving from A-1 to A-5, then to B-1, through the B-row to B-5, then back to C-1 and from that point continuing by the system used on previous plots.

Plot 5. "High-grade" Economic Selection.

Painting and tagging was begun on this plot August 24, and tallying done August 27 through September 6. Total man-days on plot were 12-3/4, of which 3 were marking plot, 2-1/4 were tagging, and 7-1/2 were tallying. Plot 5 is perhaps the easiest plot of the seven to measure.

On plot 5, the transect stake in the middle of B-3 was not found in time to paint. It is at the base of a large uprooted tree. The subplot stake between B-4 and C-3 was not found. The approximate position was marked by a painted stone, and subplot boundaries were determined from numbers on tagged trees. The iron plot boundary stake between C-1 and D-1 was not found, but the approximate position was painted from the evidence of a wooden reference stake and piled stones.

The south end of the plot was burned over in a slash fire in the fall of 1933 so that there are very few live trees in this part.

Plot 4. Seed-tree method, with removal of 88 percent of the pine by volume, and 100 percent of the fir.

The plot was marked and tagged during August 31-September 10, and measured during September 2-8, requiring a total of 17 man-days, 4 for marking plot, 8 for tagging ingrowth including numbering tags by hand, and 5 for tallying, including a tally of tagged seed trees outside the plot boundaries.

This plot was not the standard size of 10 chains square or 10 acres as all previous plots had been; for to the original plot, a sixth row of standard-sized subplots were added. Thus the plot dimensions are 10 x 12 chains, and subplot numbers run from A-1 through A-6, B-1 through B-6, and so on, to E-1 through E-6.

The plot corner stake at A-6 was not found. The displaced wooden reference stake was painted and located in the approximately correct point. The plot boundary stake between D-1 and E-1 was not found, but a painted wooden marker was set as accurately as it was possible to determine by measuring from three directions with a 100-foot tape.

The supplementary area was originally added after the tagging of the plot so that the sixth row of subplots A-6 through E-6 was tagged and tallied after the rest, going thus in the order, E-5, A-6, B-6, C-6, D-6, and E-6 to finish the plot.

The tag-man was unaware of the above discrepancy, and so in tagging the 1948 ingrowth, tagged A-5, then A-6, B-6, B-5, B-4 and so on in the established zigzag order.

In order to facilitate tallying in the future, the subplots A-6 and B-6, C-6 and D-6, and E-6, have been so listed that the sheets containing them may be readily sorted into either of the two sequences of tallying.

A further change was made in tagging procedure. In order that the ingrowth trees would not need to be located by the tally crew, it was arranged that the man tagging should note, not only diameter, but also species and damage. Thus the tally crew would only need to measure the 20 percent of the ingrowth which were to be measured for height. And since this 20 percent was not required to consist of every fifth tree in sequence, but simply a representative fifth, this arrangement saved time and searching for trees, although somewhat increasing the tag man's duties, and slightly increasing the time he required. This

innovation was begun with C-1 and thus included the entire C, D, and E rows.

As mentioned above, certain trees which were outside the plot had been left for seed trees, and these were also tagged and measured. They began near A-6, with the next consecutive number after the last one on the plot (i.e., on E-6) and continued clockwise around the plot. The approximate location of these trees is specified on the tally sheets and on the map of the study plot.

SUMMARY

Seven methods-of-cutting study plots, established in 1933 on the Boise Basin Branch Experimental Forest, were to be remeasured every 5 years. Measurements were actually made in 1933, 1938, and 1948.

In the 1948 field season measurement of plots 1 through 5 was completed by a 2-man crew. A third man nailed numbered, round aluminum tags to all trees which had not reached the required diameter of 3.6 inches or larger until after 1938.

In 1948, before each plot was measured, its borders were permanently marked by spots of yellow paint on trees along the border. Also, all the iron border stakes and subplot corner stakes were painted yellow, as were the iron Reproduction Transect stakes which crossed the plots in two directions. Subplot boundaries were marked in a temporary manner with a barkslapper.

Tree measurements were tallied in spaces provided on copied 1933 and 1938 records on standard form 114. A new set of sheets was used for the ingrowth trees tagged in 1948. Tallying followed, subplot by subplot, the consecutive order which had been established for tagging each of the plots.

Two other groups of measurements besides that for the methods-of-cutting data, were taken on the plots: A subsidiary tally of additional characteristics of Douglasfir was made on plots 2 and 3 (very little Douglasfir is found on plots 1, 4, and 5) for the purpose of developing a tree classification for the species. A count of the pine and fir reproduction on the established Reproduction Transects, was taken on all five plots.

The characteristics measured on each tree for the methods-of-cutting study included diameter, total height, crown class, Keen tree class, and damage. Height was taken with a Christen hypsometer for trees under 50 feet high, and with an abney and chain for taller trees. Tree class used in 1948 was the Keen system; the Dunning system had been used in previous tallies. Damage was coded in 1948 according to a revised code of the types of damage previously used.

On plot 1, every tagged tree was measured for height; on the other four plots only 20 percent of the immature trees were measured.

SUGGESTIONS AND RECOMMENDATIONS

On the basis of observations during the 1948 field season, the following procedures are suggested for the remeasurement of plots 6 and 7, and for all successive remeasurements of all plots.

1. In addition to permanent painted marking on the plot borders and on all iron stakes, the subplot boundaries should be marked as outlined above before proceeding with work on the plot.

2. The most efficient crew organization appears to be two crews of two men each, the first crew marking the subplot boundaries in such sequence that the second crew may meanwhile begin tagging new ingrowth,

carrying a full tally of this ingrowth as tagging proceeds. The first crew, on finishing the boundary marking, begins tallying the trees which had been tagged in previous years, pulling or resetting any tags which require it. It is preferable that the tally crew continue to follow the tag crew, rather than preceding it. This enables a check on occurrence of old trees accidentally retagged.

In the event that the tag crew were particularly efficient and careful workers, it might be advantageous to tally ahead of the tag crew, since the presence of new ingrowth tags occasions some lost time to a tally crew which is searching for specific tagged trees.

3. If only three men are in the field, the most efficient arrangement seems to be in the form of one two-man tally crew as above, with the third man preceding the tally crew, tagging new ingrowth. In this case, since it is inconvenient for the tag-man by himself to measure height, the tally crew must also visit the newly tagged trees to obtain this measurement.

Thus when plans call for height measurement of every tree, the tally crew may as well take the other measurements also, relieving the tag-man of this job. The measuring and recording of all diameters will, however, in any case be the tag-man's job, since measuring diameter is a necessary part of his tagging procedure.

If height is not to be taken on every tree, then the tally crew would not need to visit every tree tagged by the tag-man, but just the specific trees (or percentage of trees) for which height is wanted. In this case the tag-man should, for every tree he tags, keep a full tally

of all measurements except height. These other measurements would be tree number, species, diameter, damage, and Keen tree class.

4. In the event only two men are available, the procedure would be as with four men, simply tallying first, then returning to tag in the manner of the tag crew; providing that if it were convenient to have one man in the field while the other was occupied elsewhere, then a responsible crewman could tag alone, as is done in the three-man arrangement.

The idea of carrying a coin dispenser, to hold tags, has been suggested, but not yet given a trial.

5. It is suggested that in the interests of accuracy as well as saving time, all crew members who might be working with identification of Keen class, crown class, or defect, should spend some practice time judging these characters and comparing judgments, so as to gain some degree of facility before beginning a plot tally independently. This preliminary judging should make less supervision necessary and should give more consistent tallies between crews.

6. All field sheets to be used should be prepared in advance of the day they are needed in the field; and the column headings should be standardized as to title and position.

7. All crew members should be urged at all times to be alert for improvements or organization. It is entirely likely that improvements on the above will present themselves, under various field conditions.

Robert W. Richman
Forester

APPENDIX A

WORK PLAN - 1948

For the remeasurement of the Pine Creek methods of cutting plots, Boise Research Center, Idaho City.

1. Location of plots-- The permanent methods of cutting plots, 7 in number, are located in the Pine Creek drainage of the BBBS experimental forest. Plots 1 and 2 can be reached from either the west Bannock Creek road, by travelling west from a point on the road some one-half miles from the forest boundary or by following up the small creek or draw which crosses the experimental forest boundary some three-eighths of a mile from the northwest boundary of the forest. Plots 4 and 5 can be reached easily from the end of the west Bannock Creek road. Plots 3, 6, and 7 can be reached from the Pine Creek road.

2. History of plots--These plots were established from August 7 to October 19, 1933, for the purpose of determining the most suitable method of cutting old growth ponderosa pine to secure optimum growth on remaining mature trees and maximum reproduction. To accomplish this, the following silvicultural methods were adopted:

Plot 1. Clear cut to a merchantability limit of 15" d.b.h.

Plot 2. High grade economic selection cut as practiced by the local company in Boise Basin. This method removed all clear lumber from the stand leaving the thrifty young trees and some malformed, decadent, overmature trees.

Plot 3. Clear cut to a 25" diameter limit.

Plot 4. Seed tree method.

Plot 5. High grade economic selection as practiced by the Boise Payette Lumber Co.

Plot 6. F. S. tree class selection method.

Plot 7. Forest Service tree class selection method.

3. Measurements.--On each plot, for each tree 3.6" d.b.h. and up, the following records will be made: record of subplot, species, diameter breast high, height, a check with diameter and height of two previous measurements, Keen tree class, mortality, or injury and cause.

It may be necessary to lay string to determine boundaries of subplots. Diameters will be measured by diameter tape, height by abney level and chain for trees above 50 feet and Christen hypsometer for trees up to 50 feet. (Height measurements with hypsometer should be made on larger trees from uphill side. Abney level should be adjusted and then checked once a week.)

The results of research are only as reliable as the measurements comprising the body of information. Accuracy of measurement, therefore, should not be sacrificed for speed. Measurements, counts, etc. should not be secured mechanically; mental checks will increase the accuracy and efficiency of field work.

Diameter measurements should be so taken that the plane of the tape, circumference should always be at right angles to the vertical axis of the tree.

Nails holding tags should be withdrawn by a carpenter's hammer slightly, or, withdrawn and reset if necessary, on all stems where required.

4. Crew make-up--When four men are available, two two-man crews will operate; when three men are available, one three-man crew will operate. In the latter case, one man will record, one man will take

heights, and the third man will take the remaining measurements. The recorder will assist or check the estimation of tree class. Those taking heights and diameters can alternate at suitable intervals to avoid tediousness.

5. Note taking--Records will be taken on standard form 114, a new copy of which shall have been made from the original and which shall contain plot number, plot size, dates of measurements, crew names, number of sheet subplot number, tree number, species, previous diameters, previous heights and mortality and cause. Separate notes should be made of stump counts for age on 10 to 20 of largest stumps available. All figures should be clearly set down and checked in the field at the end of each day for clarity and accuracy. Forms should be prepared in advance of the days work to avoid delay.

6. Order of plot measurement--Plots should be measured consecutively from 1-7.

7. Tools and accessories--A small pole axe, a carpenter's hammer, a set of numbered tags (1-500) strung on a wire, a number of No. 10 case, galvanized nails in a can provided with a wire bale, should be taken to each plot when work is begun. They may be left on the plot at a central, prominent location, until the work is completed and, excepting the axe, should be carried as the work proceeds. The ingrowth trees should be tagged at d.b.h. as the work proceeds consecutively from the last numbered tree (obvious from the record sheets). Any missing tags on larger trees should be noted and replaced the following day by blank tags which can be numbered at headquarters with the die set of punches.

8. Operation--Chief of party will be responsible for efficiency of the field work. Instruments must be checked and instruments and tools kept in good working order. Each man should understand his duties completely. Notebook, necessary forms, pencil and eraser, and other equipment necessary for the day's work should be readied the night before so that delay is avoided in the morning.

Field crews should be alert to personal observations which might assist in explaining results of the study involved o r which would supply new information on any biological phenomena whether or not it is connected with the study and which cannot be recorded in any other way. Sheets should be kept in the notebook for this purpose and notes made neatly thereon, dated, and author's name recorded.

James D. Curtis
Silviculturist

RS - INT
M-1 or Mc
Pine Cr. Plots-
General

APPENDIX B — Effective June 1, 1933

Code for Individual Tree Records:
Permanent Sample Plots (M-1 or Mc)
Pine Creek Timber Survey

Species

1. Ponderosa pine
2. Douglasfir
3. Lodgepole pine
4. Alpine fir
5. Engelmann Spruce
6. White fir
7. Western larch

Tree Class (Dunning)

1 to 7 per standard definitions for pine; similar for other species except no class 7.

Crown Class

1. Dominant
2. Codominant
3. Intermediate
4. Suppressed
5. Isolated

Economic Tree Class (Anderson)

1. Young bull pine
2. Older bull pine
3. Shop type
4. Select type
5. Inferior tree

Release by Cutting

0. None
1. 1/4 released
2. 1/2
3. 3/4
4. Total

Cone Crop Class

- Too small or suppressed for cone production
0. None
1. 1 - 10
2. 11 - 25
3. 26 - 50
4. 51 - 75
5. 76 - 100
6. 101 - 200
7. 201 - 400
8. 401 - 600
9. 601 - 1000
10. 1001 - 2000
11. Over 2000

Defects (Two code numbers, first for general class of defect, second for specific kind or degree)

1. **Mistletoe**
   1. Light
   2. Medium
   3. Heavy
   4. Practically dead
2. **Fire**
   1. Catface 0-8', shallow
   2. " 0-8', deep
   3. " over 8', shallow
   4. " over 8', deep
   6. Crown injury, slight
   7. " " , serious
3. **Form**
   1. Forked, serious
   2. Crooked "
   3. Spiketop "
   4. Wolf tree, unmerch.
   5. Old tip inj.; recovering
4. **Wind or Snow**
   1. Top broken
   2. Limbs stripped
   3. Serious lean
   4. Windfall
   5. Catface from skinning*
5. **Rot** — 1. Butt 2. Bole 3. Top
6. **Porcupine**
   1. Limbs peeled
   2. Slight bole damage (not girdled)
   3. Medium bole damage (usually too girdled, or many scars)
   4. Heavy (nearly dead)
7. **Lightning**
   1. Creased
   2. Top broken out
   3. Bole shattered
   4. Other
8. **Insects** (Barkbeetles unless otherwise noted)
   1. Light (or see
   2. Medium (Special code,
   3. Heavy (July 1934
9. **Logging**
   1. Top broken
   2. Side-swiped top
   3. Serious lean
   4. Butt scar
   5. Root damage
   6. Other

Cause of Death - same as for Defect, except
0. Unknown
3. Suppression

* First used 1938

APPENDIX C

CODE OF DAMAGE AND CONDITION
FOR PINE CREEK METHODS-OF-CUTTING, PLOTS, 1948

DAMAGE

DEFECT (underline if in first log)	CAUSE OF DEFECT (Number omitted if cause unknown)	SEVERITY OF EXTENT
1. Catface	1. Mistletoe	a. Slight
2. Galls or canker	2. Fungi	b. Medium
3. Crook	3. Lightning	c. Heavy
4. Sweep	4. Wind & snow	d. Extreme
5. Fork	5. Suppression	
6. Spiketop	6. Logging	
7. Rot	7. Fire	
8. Thrown or severely bowed	8. Insects (old or recent)	
9. Broken stem	9. Porcupine (old or recent)	
10. Dead	10. Limby or "wolf" tree	

When it appears that damage has occurred within about the past 2 years, the word "new" is written with the code marking.

General Use of Severity Rating

Cause 10 indicates "wolf" tree if extent of limbiness is marked "c" (heavy) or "d" (severe or extreme). Thus 11-10c indicates wolf tree, in form, while 11-10d indicates a wolf tree which is actively suppressing other trees.

Damage is rated in severity as follows: Damage which seems to impair neither vigor nor present market value of the tree, is "a", slight. Damage which girdles the tip or otherwise reduces somewhat the vigor of tree or its market value, is called "b", moderate. Damage which injures the first log, (i.e., the lower 16 feet of the bole) or otherwise reduces the vigor or health considerably, is "c", heavy.

Damage which endangers the life of the tree or destroys its market value, is "d" severe or extreme.

The number of recurrent attacks may be indicated by a figure circled, after designated code.

CROWN CLASS

D Dominant
C Codominant
I Intermediate
S Suppressed
O Open-growth, or isolated

When tree is naturally open, the coding becomes both crown class and "O" for open position, thus: I O

When tree is only partially open (only on two sides) the coding is underlined as: I O

When two trees are close together, but isolated as a pair, the coding is as follows: $\frac{I}{I}\frac{O}{O}$

PERMANENT SAMPLE PLOTS ENUMERATION SHEET

Plot No.: .....
Location: .....
Dimensions: .....

DATES	MEASURED BY	TALLIED BY

Tree No.	Species	Diam. D.B.H. inches & tenths 1928	1933	1948	Height in feet 1928	1933	1948	Crown class '28	'33	'48	Damage, 1948	Other damage & remarks
1												
2												
3												
4												
5												
6												
7												
8												
9												
0												
1												
2												
3												
4												
5												
6												
7												
8												
9												
0												
1												
2												
3												
4												
5												
6												
7												
8												
9												
0												
1												
2												
3												
4												
5												
6												
7												
8												
9												
0												

M-1

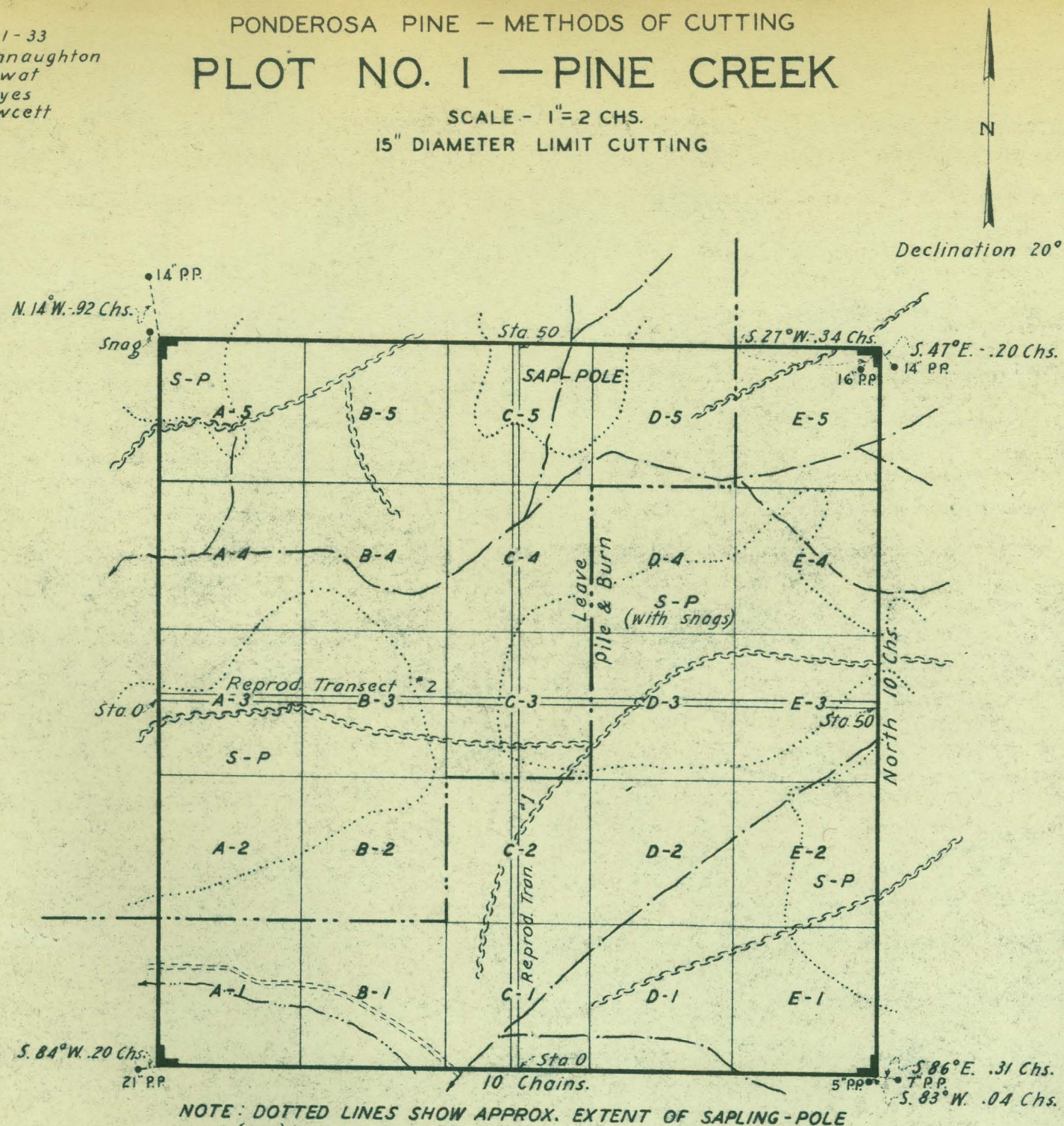
6-1-33
Connaughton
Mowat
Hayes
Fawcett

PONDEROSA PINE — METHODS OF CUTTING

PLOT NO. 1 — PINE CREEK

SCALE - 1" = 2 CHS.

15" DIAMETER LIMIT CUTTING



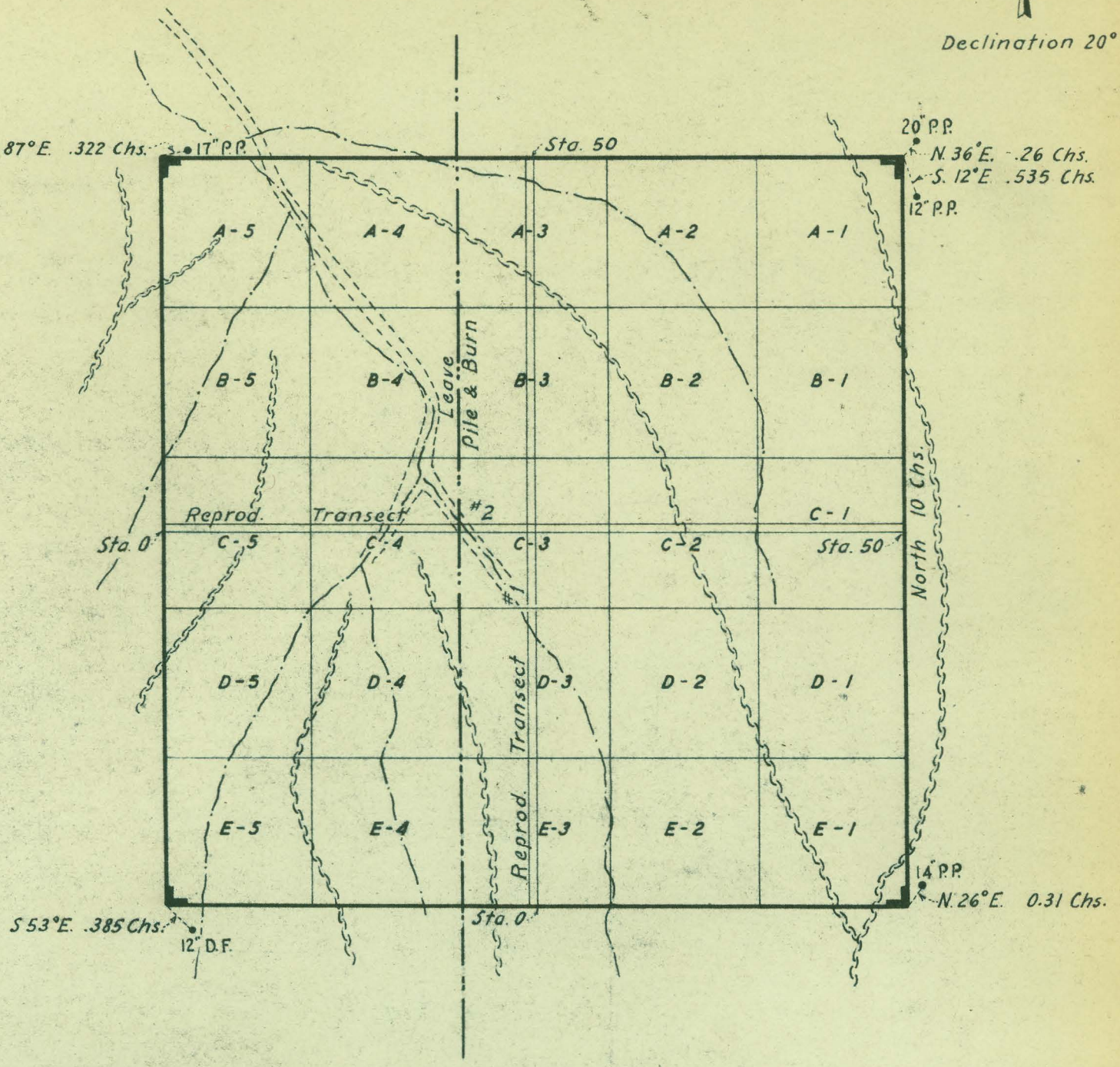
NOTE: DOTTED LINES SHOW APPROX. EXTENT OF SAPLING-POLE (S-P) THICKETS.

FILE COPY

6-5-33
Mowat

PLOT NO. 2 — PINE CREEK

SCALE 1" = 2 CHS.
ECONOMIC SELECTION CUTTING



6 - 22 - 33

E. L. M.

G. L. H.

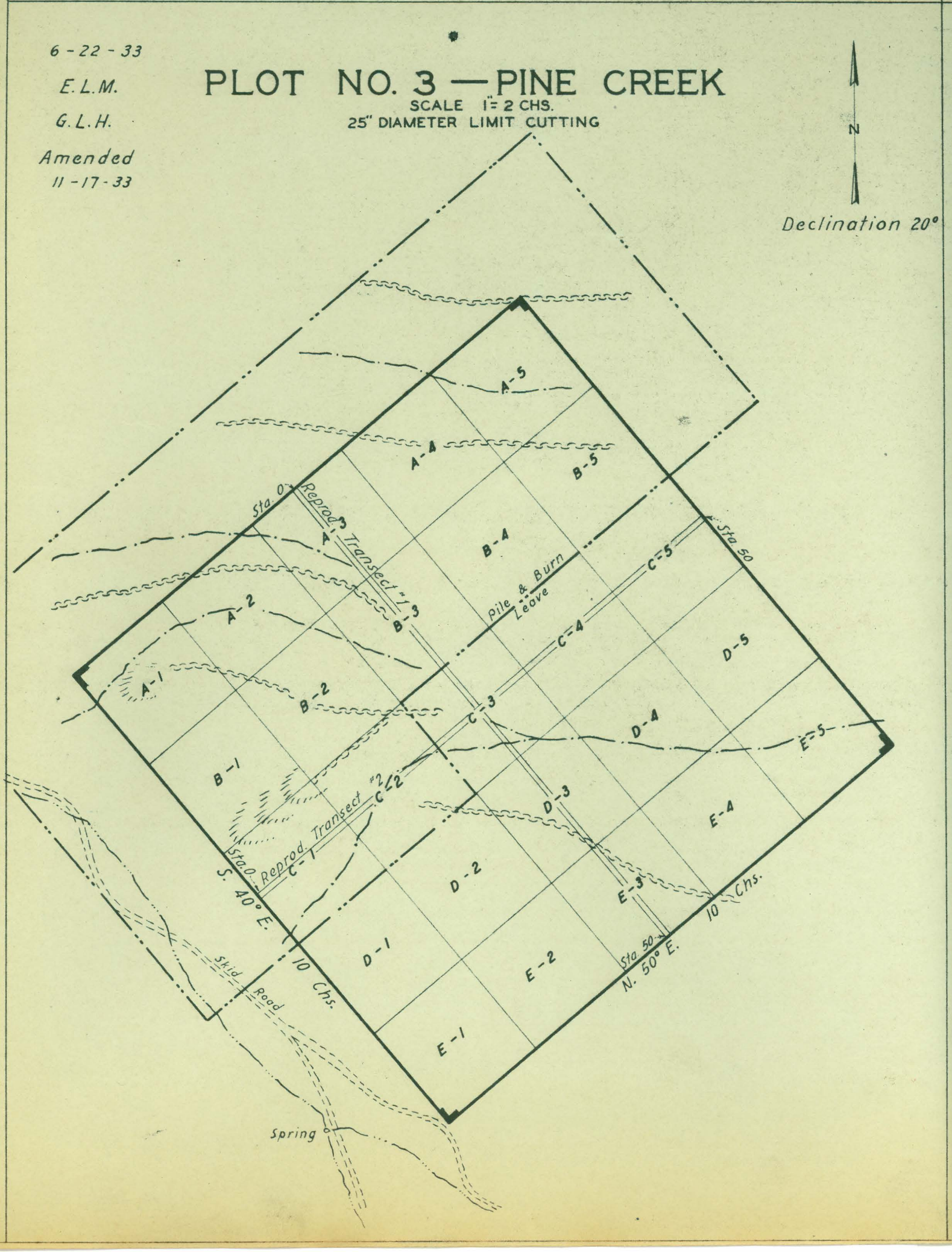
Amended

11 - 17 - 33

PLOT NO. 3 — PINE CREEK

SCALE 1" = 2 CHS.

25" DIAMETER LIMIT CUTTING

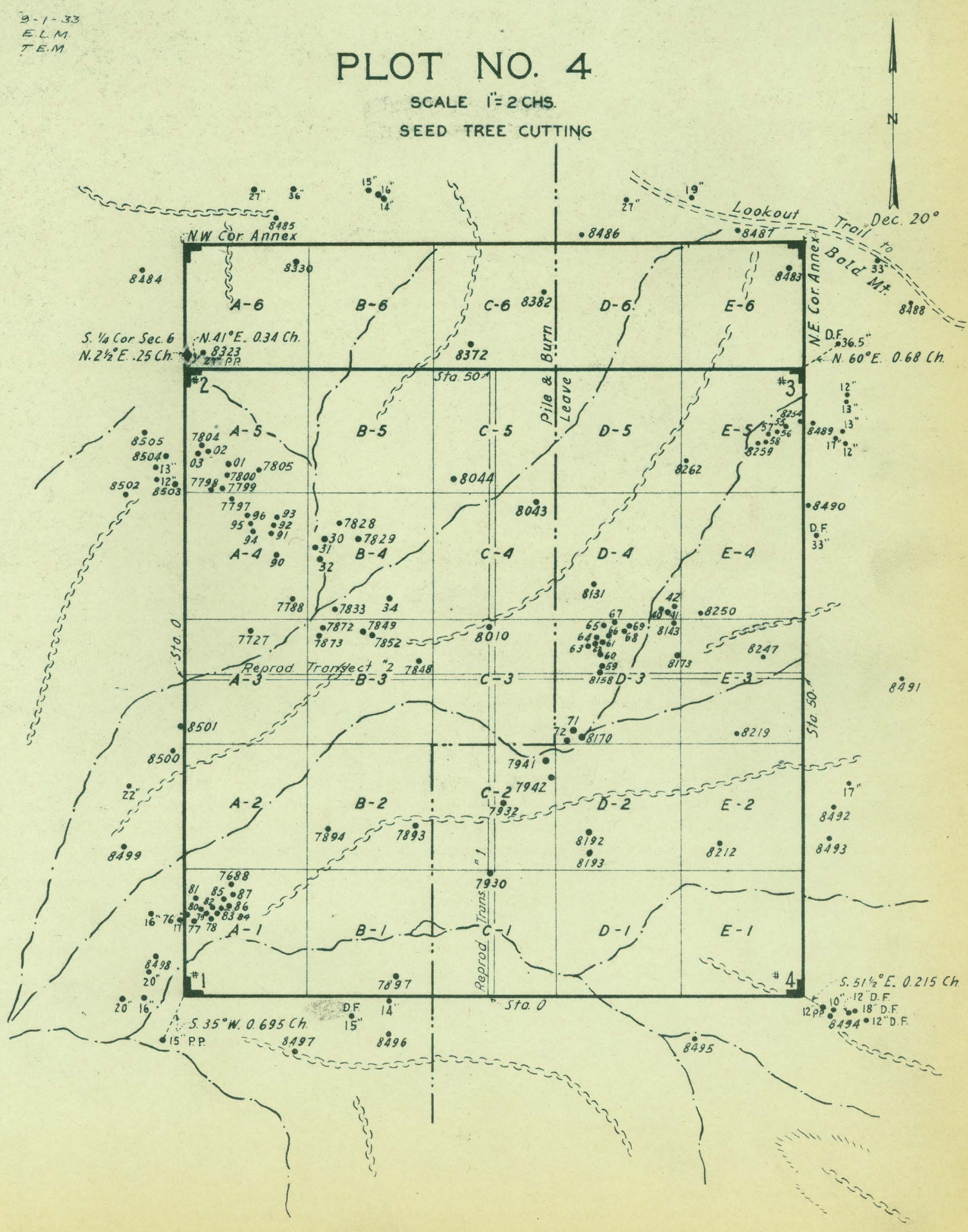


9-1-33
E.L.M.
T.E.M.

PLOT NO. 4

SCALE 1" = 2 CHS.

SEED TREE CUTTING


N
Lookout Trail to Bold Mt.
Dec. 20°
N.W. Cor. Annex
N.E. Cor. Annex
S. ¼ Cor. Sec. 6
N. 41° E. 0.34 Ch.
N. 2½° E. .25 Ch.
N. 60° E. 0.68 Ch.
S. 35° W. 0.695 Ch.
S. 51½° E. 0.215 Ch.
Sta. 50
Sta. 0
Pile & Burn Leave
Reprod. Transect "2"
Reprod. Trans. #1
A-6 B-6 C-6 D-6 E-6
A-5 B-5 C-5 D-5 E-5
A-4 B-4 C-4 D-4 E-4
A-3 B-3 C-3 D-3 E-3
A-2 B-2 C-2 D-2 E-2
A-1 B-1 C-1 D-1 E-1
#1 #2 #3 #4

Traced By B.F.T.

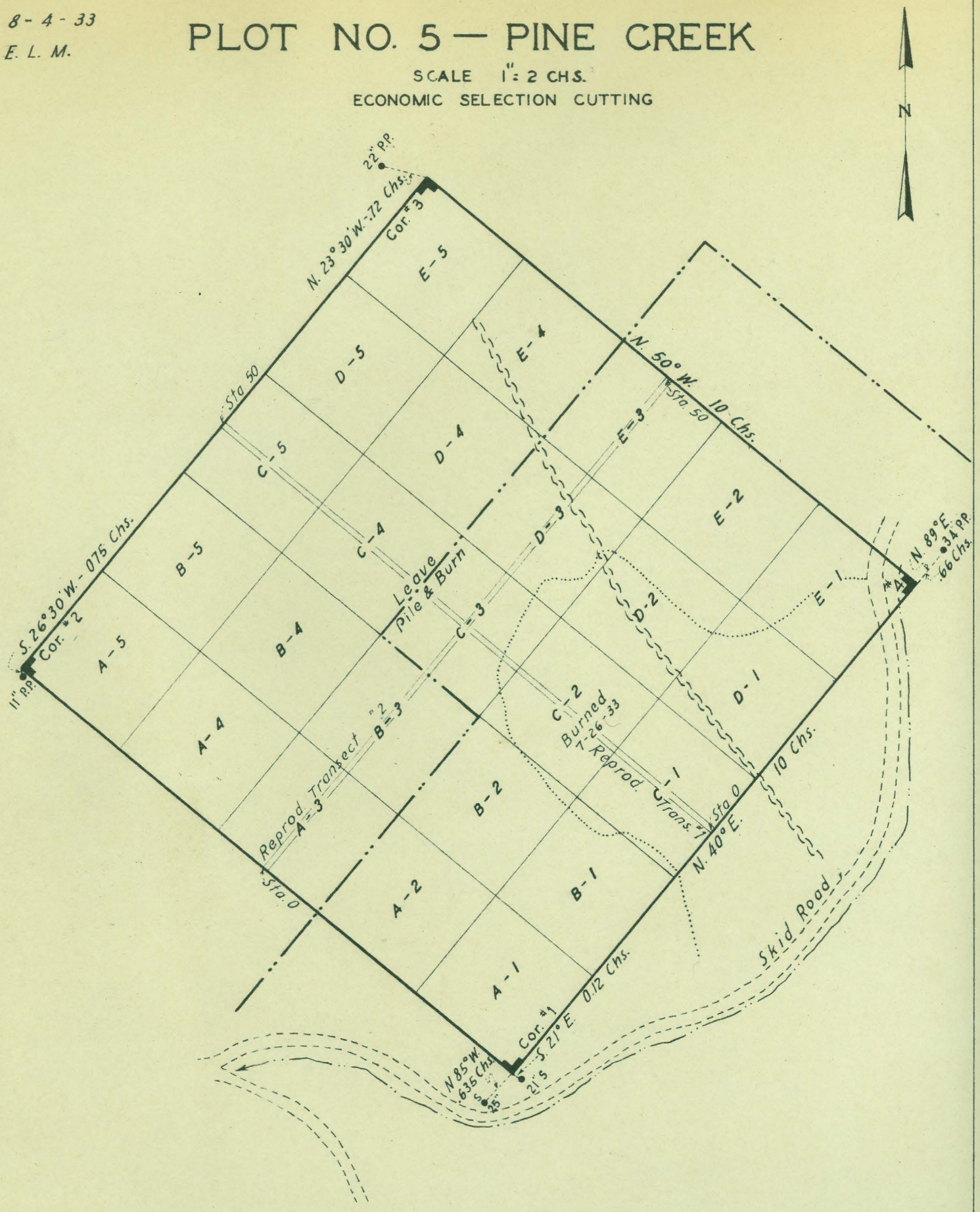
FILE COPY

8 - 4 - 33
E. L. M.

PLOT NO. 5 — PINE CREEK

SCALE 1" = 2 CHS.

ECONOMIC SELECTION CUTTING



PLOT NO. 6 — PINE CREEK

7-18-33
T. E. MAKI

SCALE 1" = 1 CHAIN

TREE CLASS SELECTION CUTTING

N

DECLINATION 20°

15" P.P.
N. 11° W - 0.38 Chs.
COR. # 2

COR. # 3

COR. # 4

COR # 1

S. 19° 30' W .51 Chs.

19" P.P.

38" P.P. Stu

Reprod. Transect # 2

Transect # 1

Reprod. Transect

A-5 B-5 C-5 D-5 E-5

A-4 B-4 C-4 D-4 E-4

A-3 B-3 C-3 D-3 E-3

A-2 B-2 C-2 D-2 E-2

A-1 B-1 C-1 D-1 E-1

10 Chains

North

Pine C

R.R. Grad

FILE COPY

PLOT NO. 7 — PINE CREEK

7-26-33
E.L. MOWAT

SCALE 1" = 1 CHAIN

TREE CLASS SELECTION CUTTING

N

DECLINATION 20°

35" P.P. Stump
N. 74° E. 0.21 Chs.

No B.T.

COR.# 3 | COR.# 2 | COR.# 3

A-5 | B-5 | C-5 | D-5 | E-5

A-4 | B-4 | C-4 | D-4 | E-4

A-3 | B-3 | C-3 | D-3 | E-3

A-2 | B-2 | C-2 | D-2 | E-2

A-1 | B-1 | C-1 | D-1 | E-1

10 Chains

North

Reprod. Transect # 2

Transect # 1

Pile & Burn Leave

Transect Reprod.

50 | 1 | 50

R.# 4 D.F.S.

N. 62° E. .23 Ch. 3931
37" P.P. Stump

S. 26° W. .23 Chs.
38" P.P. Stump

N. 14° W. .73 Ch.
B.T. 36" P.P. 34"
C.# 4

Pine Cr.

R.R. Grade

Note: This is only copy with cut-tree numbers and d.b.h.'s indicated.

Traced - B.F.T.